The National Flow Cytometry Resource at Los Alamos National Laboratory

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The National Flow Cytometry Resource (NFCR) advances flow cytometric analyses through innovative research and development, collaborations, service, dissemination and training. Flow cytometry is a technique for high-speed analysis of individual particles ranging in size from single molecules and macromolecular complexes to subcellular organelles, cells, and cellular aggregates. Particles pass rapidly through one or more focused laser beams where probe molecules bound to specific components, such as DNA in cells, are excited and the emitted fluorescence photons are detected. Measurement of fluorescence emissions and scattered excitation light provides quantitative information about the particles. For cells, measurements are made of DNA, RNA, and protein content; surface molecules; internal antigens; and physiological parameters. There are also a wide variety of assay systems based on microspheres, including: specific DNA/RNA binding; protein analysis; protein-protein and protein-nucleic acid interactions; and enymatic activity. Since individual particles are analyzed, distributions of these and other measured parameters are obtained at analysis rates of thousands of events per second. Based on the measurements, particles in selected subpopulations can be physically separated by sorting. There are currently four R&D projects ongoing in the NFCR: 1) applications of high sensitivity flow cytometry; 2) development of novel molecular assembly assays; 3) development of novel protein-protein interaction assays; and 4) full spectral resolution flow cytometry. Unique flow cytometric capabilities in the NFCR include: high-resolution chromosome analysis and sorting; fluorescence lifetime measurement; rapid-mix analyses with subsecond time resolution; phase-sensitive fluorescence detection; DNA fragment size quantification; ultrasensitive fluorescence detection; full spectral analysis; and a robust, flexible digital data display and analysis system. The NFCR also houses a User Facility for collaborations and service projects, which provides access to two commercial cell sorters, three commercial cytometers, a multiplex array analyzer, a scanning fluorimeter, a scanning spectrophotometer and extra workstations for data analysis. Expert advice and assistance are available to collaborators in the areas of: cellular and chromosome sample preparation; multiplexed genetic and protein analysis; rapid kinetic analyses; macromolecular assembly dynamics; intrinsic property analysis; multivariate data acquisition and analysis; sorting procedures; and instrument development and troubleshooting.

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